

The Kavli Institute for Cosmological Physics

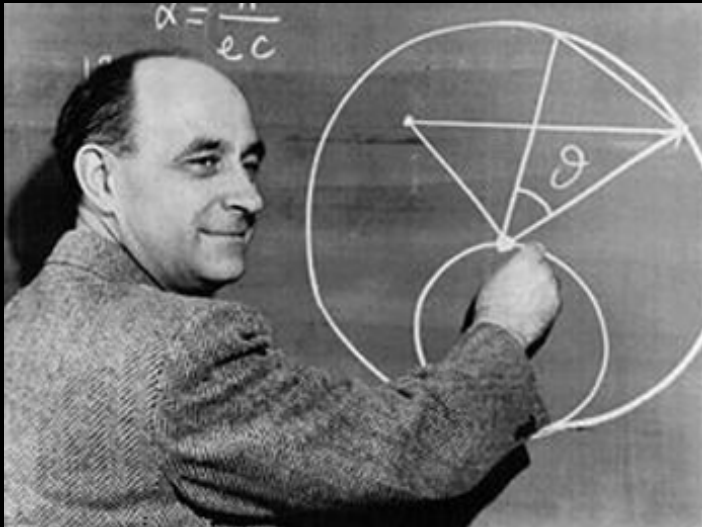
"KICP scope and overview of KICP experiments"



30 senior members
34 fellows & assoc fellows
42 graduate students

KICP Vision

“To deepen our understanding of the origin and evolution of the Universe and the laws that govern it by bringing together astronomers and physicists within a unique interdisciplinary culture.”





KICP/PFC first 10 years

The Questions:

1. What is the nature of the Dark Energy that dominates the Universe, and what is its impact on the evolution of the Universe?
2. Was there an inflationary epoch in the first moments of the Universe, and if so, what is the underlying physics that caused it?
3. What clues do nature's highest energy particles tell us about physics, astrophysics and cosmology.

KICP first 10 years

The Experiments:

1. CMB: DASI-pol, CapMap, QUAD, QUIET, SPT
2. Dark Energy: SZA, SDSS-II, SPT, DES
3. Particles: Auger, Veritas, COUPP, MIDAS

KICP first 10 years

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Initiated after start of KICP with flexible seed funding

The PFC at the KICP

“Pushing Cosmology to the Edge”

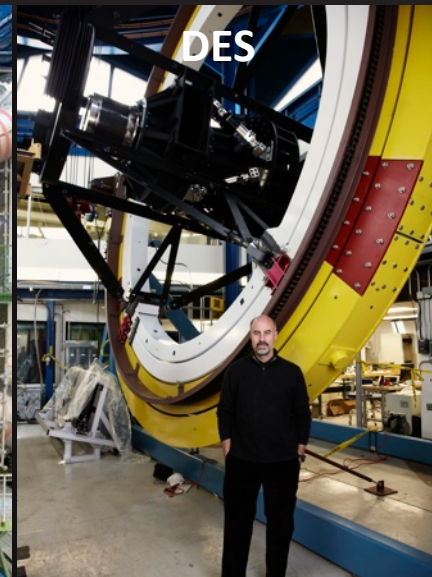
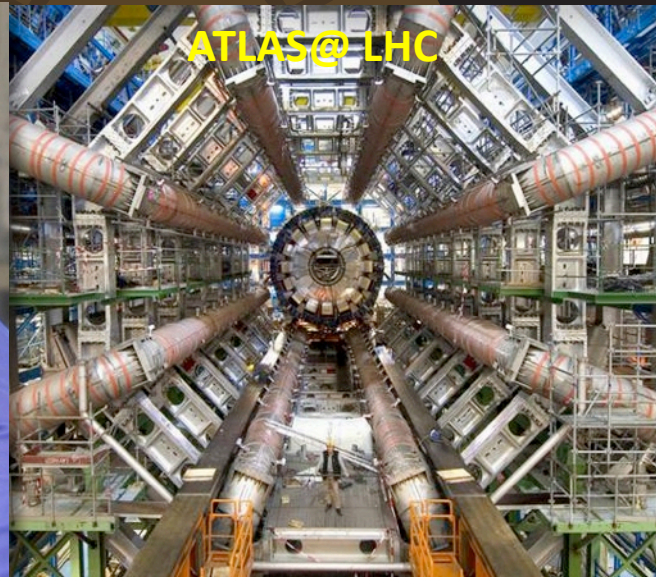
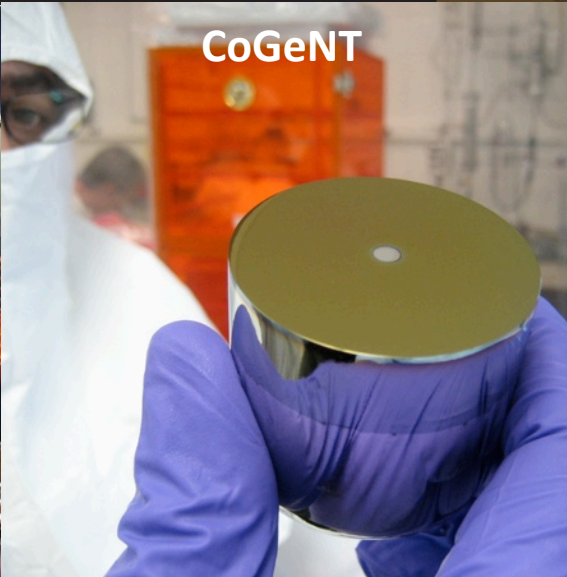
(continued NSF funding for next 4+ years...)

The questions:

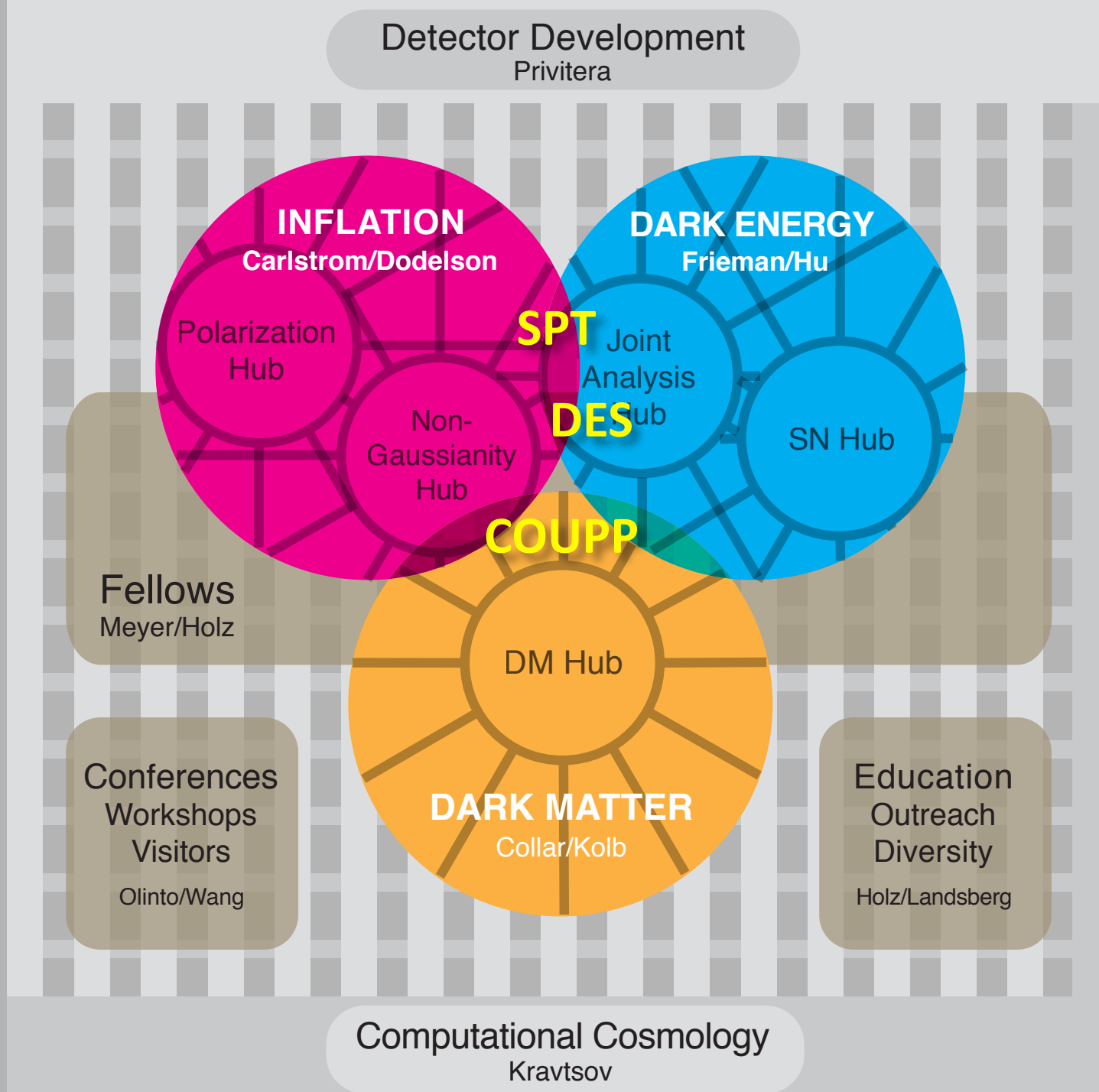
1. Did the Universe undergo inflation and if so what drove inflation?
2. What is the dark energy that is causing the Universe to accelerate?
3. What is the dark matter that holds together all cosmic structures?

The key goals/experiments

- Detect CMB polarization signature of inflation gravity waves and determine energy scale of inflation
- Probe dark energy at few %
- Identify the dark matter particle



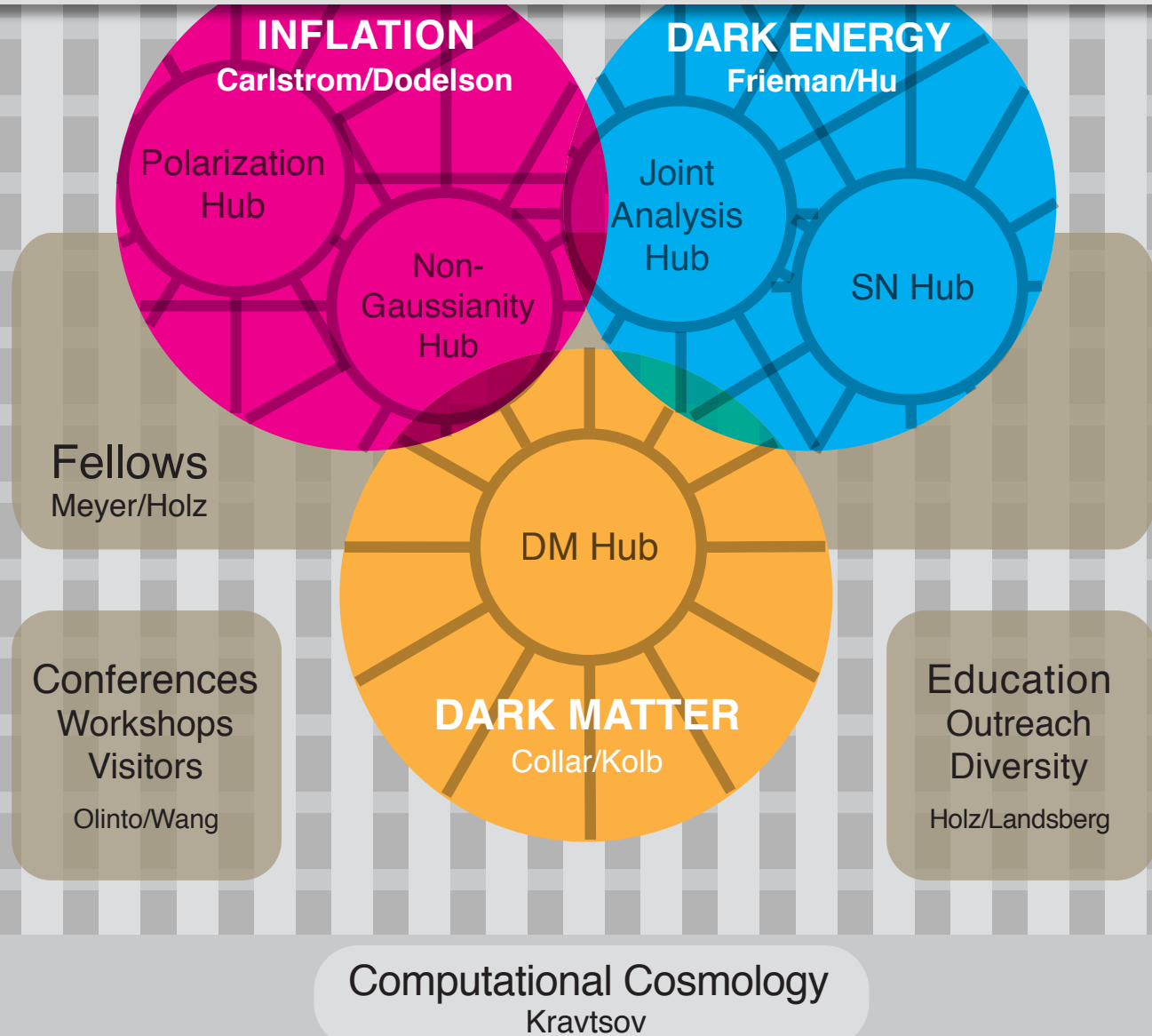
Conceptual organization



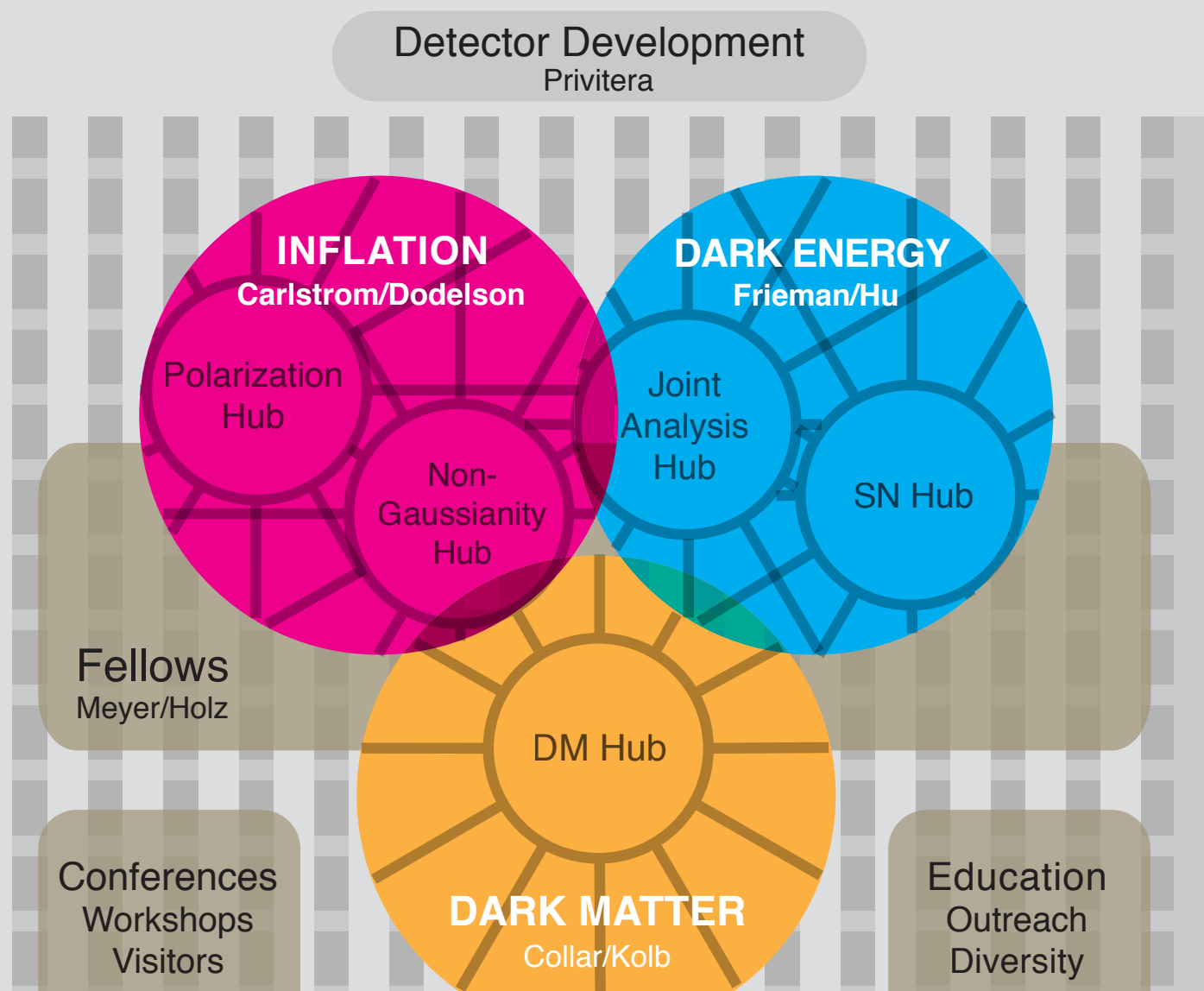
Detector Development

Privitera; Carlstrom, Collar, Meyer + 8 Key Collaborators

“Enable scientific breakthroughs by pushing the scale and sensitivity of mm-wave and dark matter detectors to their technological limits.”

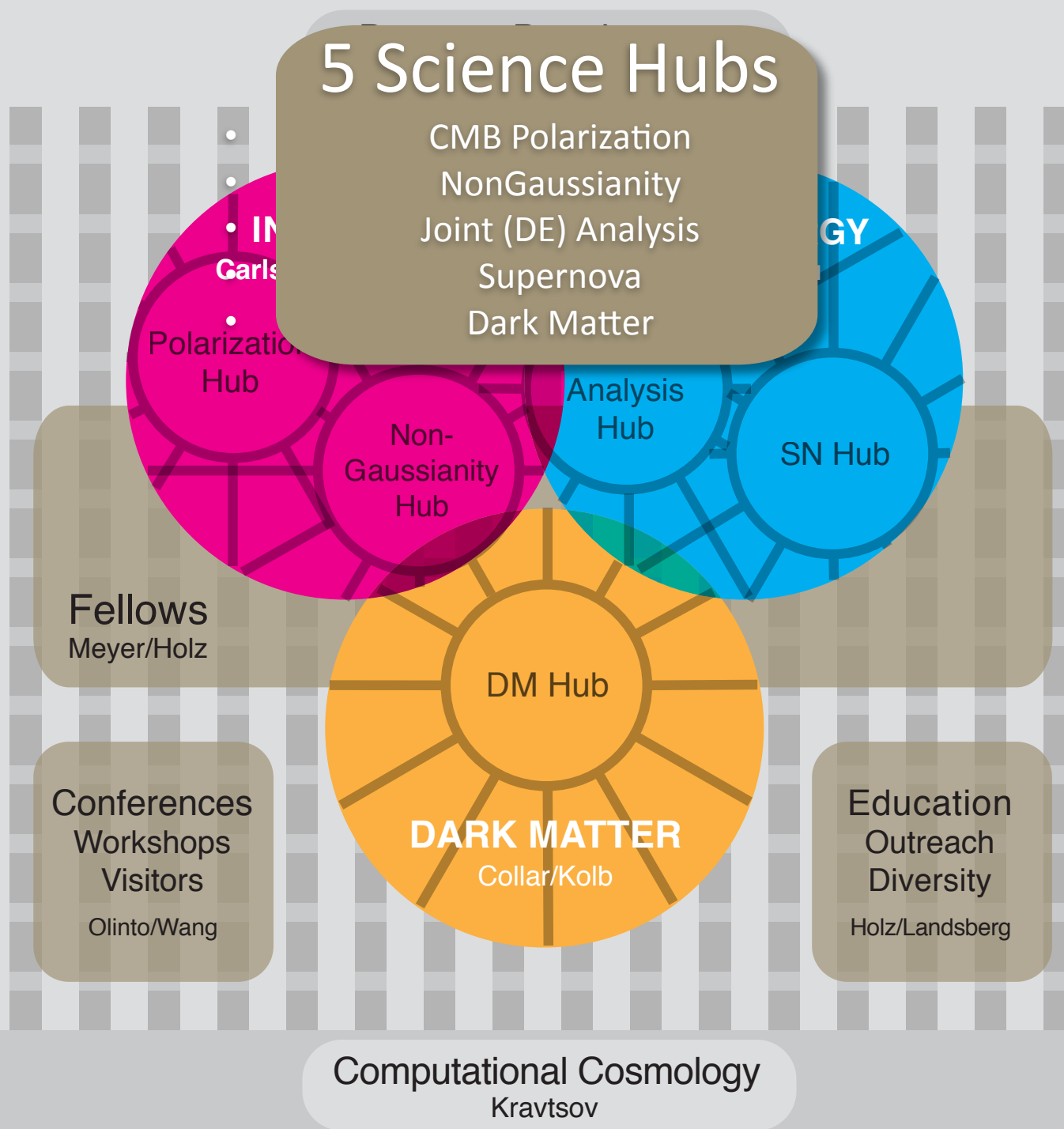


Conceptual organization



Computational Cosmology Kravtsov; Dodelson, Gnedin, Habib, Heitmann

“Provide the high-performance computing framework needed to address the key cosmology questions and to train the next generation of researchers to thrive in the massively parallel computing era.”



New PFC experiment initiatives

- DM: Seeding COUPP 500
 - *Progressing from COUPP-4 to COUPP-60 to COUPP-500 kg*
 - Design study to prepare for 2-Gen dark matter detector competition (Juan's talk)
- DE: Seeding DESpec
 - *Redshifts for ~7 million DES galaxies (in ~270 nights), ~20 million from DES+LSST (~800 nights) for dark energy constraints*
 - Seeding design study, optics prototyping, survey strategy for spectroscopic survey after DES (Brenna's talk)
- Inflation: Seeding SPT-3G
 - *Increase from 1500 → 15,000 polarization detectors for SPT to constrain energy scale of inflation and mass of the neutrinos*
 - Seeding new multichroic pixels and camera development with ANL detector fabrication (Clarence's talk)



next

*new ideas & bold initiatives
for science breakthroughs*

- ★ mKID detectors (CMB?, DM, optical imaging spectroscopy,...)
- ★ Multimode detectors for CMB polarization, PIXIE (Meyer)
- ★ DM detection with CCDs, Cloud chambers (Paolo)
- ★ Workshop on next gen UHECR experiment: JEM EUSO (Angela)

discover next great idea today?